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ABSTRACT

Sixty students in 10 classrooms in 5 high schools were extensively observed over a 10-week period during the fall semester of 1982. Based on pre- and posttests to measure achievement gain on algebraic objectives and change in attitude, the study investigated the relationships between student achievement and variables of student behavior, instructional strategy, and time on task. In addition to the text, the data are illustrated in nine charts. Significant positive relationships were found between achievement gain and the lecture/discussion method, the amount of time students spent on tasks related to the learning objective, and students' total engaged time. Significant negative relationships were found between academic gain and directed study strategy, the amount of time students spent on tasks not related to the learning objective, and students' total unengaged time, including waiting for help. A significant positive relationship was found between the lecture/discussion strategy and the amount of time students spent on task. Achievement gains for individual classrooms were significantly related to minutes of time on task per classroom. Implications of these findings for teachers and administrators are discussed. (MLF)

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TIME/LEARNING RELATIONSHIPS IN SECONDARY SCHOOLS: A RESEARCH REPORT

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TIME/LEARNING RELATIONSHIPS IN SECONDARY SCHOOLS: A RESEARCH REPORT

by

Edward H. Seifert John J. Beck, Jr.

ABSTRACT

Sixty students in ten classrooms among five high schools were extensively observed over a ten-week period during the fall semester of 1982. The research question investigated was whether or not evidence of certain task behaviors among students was related to student achievement. Based on pre- and post-tests to measure achievement gain on algebraic objectives and change in attitude, significant relationships ($p \leq 0.05$) were found among these variables and various time-on-task related variables. Significant positive relationships were found between achievement gain and time spent in the lecture/discussion teaching strategy; between achievement gain and time spent in covert task behaviors; between achievement gain and time spent in all on-task behaviors; between achievement gain and attitude change; and between the amount of time spent in the lecture/discussion teaching strategy and the time spent on-task. Significant negative relationships were found between achievement gain and the amount of time spent in seatwork; between achievement gain and the amount of time spent working off the objective; between achievement gain and the amount of time spent waiting for help; between achievement gain and time spent in all off-task behaviors; and between achievement gain and the amount of unengaged time.

"TIME LEARNING RELATIONSHIPS IN SECONDARY SCHOOLS:
A RESEARCH REPORT"

Improvement of schooling and the search for ways to improve school effectiveness continue to be popular endeavors among educators as they strive to meet the modern demands of educating America's youth. These endeavors have apparently yielded less success at the secondary school level than at the elementary level. In a recent Phi Delta Kappan, Eleanor Farrar, Vice-President of the Huron Institute said that, in general, school reformers have by-passed the more complicated secondary schools. She continued by saying "consequently, there hasn't been much change in high schools, and there hasn't been much improvement." (Newsnotes, Phi Delta Kappan, 1983)

Recent attention to efforts to improve school effectiveness, brought to the forefront in large measure by the new accountability movement, has invariably led to a consideration of time as an influencing variable. Researchers may disagree on the best ways to evaluate the influence of this variable, but little disagreement exists concerning the notion that time is a crucial variable. (Salmon, 1982)

Concerns about the purported importance of time, coupled with the relative lack of research in a secondary school setting, led to the following research questions:

1. Do relationships exist between student achievement gains and selected time-related variables at the secondary level?
2. Do relationships exist between student attitude changes and selected time-related variables at the secondary level?

Review of Related Research

Effective schools tend to characteristically demonstrate allegience to several factors which make a difference in effective instruction. Edmonds (1982), in an overview of effective schooling research, listed five characteristics of effective schools:

1. Strong leadership and attention to the quality of instruction by the building principal.
2. A pervasive and broadly understood instructional focus.
3. An orderly and safe climate conducive to teaching and learning.
4. Teacher expectations that all students can achieve minimum mastery.
5. Use of pupil achievement measures as a basis for program evaluation.

High staff expectations for students influence how time is used in the classroom. The degree of influence is affected by school policies enforcement practices, and by classroom practices and behaviors which consistently communicate to students that success is expected and reachable (Murphy, et al., 1982). Murphy reported that the classroom practices which make a difference in academic expectations are:

1. Establishing an academically demanding climate.
2. Conducting an orderly, well-managed classroom.
3. Ensuring student academic success.
4. Implementing instructional practices that promote student achievement.
5. Providing opportunities for student responsibility and leadership.

The common variable in these effective practices is time. Each of the five critical practices is time dependent. This set of expected practices must be expanded to include a systematically planned consideration of time by the teacher. Berliner includes three time-related behaviors among the six behaviors to look for when observing classrooms (Brandt, 1982):

1. Time allocation
2. Engagement rates
3. Time management
4. Match of instructional materials to the goals of the school.
5. Classroom management and discipline
6. Politeness and kindness

Clauset (1982) reports that allocated time is in large measure a function of school policies and may be outside the sphere of influence for many teachers. With respect to engaged time, however, Clauset shows that this variable does influence the level of achievement among students.

Perhaps the landmark research on the issue of time and learning was the Beginning Teacher Evaluation Study (BTES). This major enterprise, funded by the National Institute of Education through the California Commission for Teacher preparation and licensing, sets benchmarks for identifying the conditions and skills a teacher needs to teach effectively. Conducted among elementary school subjects, the BTES researchers (Fisher, et al., 1980) developed a measure of student classroom learning called Academic Learning Time (ALT), defined as the amount of time a student spends engaged in an academic task that can be performed with high success by the student. ALT is derived from engaged time which is that part of allocated time during which the student is paying attention. Allocated time is the time available during school hours for a student to work on instructional objectives. Using these three time measures as references, the researchers delineated fourteen major findings:

1. The amount of time that teachers allocate to instruction in a particular content area is positively associated with student learning in that content area.

2. The proportion of allocated time that students are engaged is positively associated with learning.

3. The proportion of time that reading and mathematics tasks are performed with high success is positively associated with student learning.

4. The proportion of time that reading or mathematics tasks are performed with low success is negatively associated with student learning.

5. Increases in ALT are not associated with more negative attitudes toward mathematics, reading, or school.

6. The teacher's accuracy in diagnosing student skill levels is related to student achievement and ALT.

7. The teacher's prescription of appropriate tasks is related to student achievement and student success rate.

8. More substantive interaction between the student and an instructor is associated with higher levels of student engagement.

9. Academic feedback is positively associated with student learning.

10. Structuring the lesson and giving directions on task procedures were positively associated with high student success.

11. Explanation specifically in response to student need is negatively associated with high student success.

12. More frequent reprimands for in appropriate behavior are negatively associated with student learning.

13. The teacher's value system is related to ALT and to student achievement. Teacher emphasis on academic goals is positively associated with student learning.

14. A learning environment characterized by student responsibility for academic work and by cooperation on academic tasks is associated with higher achievement.

Method and Organization of the Study

Five high schools in central Texas were selected as research sites. The selections were made based on accessibility and size. In order to investigate the relationship of size of school to student achievement, an attempt was made to include as many different school sizes as was possible.

Within each high school, two sections of first-year algebra students were identified after consultation with the building principal, the classroom teachers, and the department chairpersons in each school. First-year algebra was the discipline selected for the research under the assumption that objectives for this discipline were more likely to show greater similarities among schools than objectives from other disciplines.

After the schools and the classrooms were identified, each was labeled in the following manner for bookkeeping purposes and to avoid the possibility of unfair comparisons being drawn according to school names:

School	Period	# Students	Teacher
A	2	17	A1
A	3	24	A2
B	2	25	B1
B	3	18	B1
C	2	21	C1
C	3	12	C2
D	5	30	D1
D	6	33	D1
E	5	25	E1
E	6	19	E2

A pre-test on first-year algebra objectives (See Appendix A) and a pre-test on attitude toward mathematics (See Appendix B) were administered to every student in each of the ten sections. These pre-tests were administered during the same week in early October of 1982. Scores from these pre-tests were used to identify the research subjects as well as to provide baseline data for research analysis.

Six students, three male and three female, were identified in each classroom as research subjects. The identification was based on the nearness of the pre-test scores to the classroom mean for each test. That is, the six students whose scores were nearest to the classroom mean on both content and attitude were the subjects selected for further research. Only the researchers knew the identity of the six subjects during the research. Neither the students nor the teachers were given this information.

An observation schedule was determined so that each subject in each classroom would be observed during ten complete class periods over a course of ten weeks. The schedule was given to the classroom teachers. The teachers always knew when the researchers would be present in the classroom, but the teachers were never aware of which students were being observed.

The Student Observation Form (See Appendix C) was developed after reviewing the instrumentation used in the Beginning Teacher Evaluation Study. The Student Observation Form (SOF) was designed to take advantage of the unique qualities of the secondary classroom. After the design was completed, the researchers tested it in classroom simulations to insure consistency among observers and to reach a subjective measure of internal validity of the instrument.

The observations were designed on a timed, rotating cycle format in such a manner that each subject was observed at ten equally spaced time intervals during each class period. Each observation of a particular subject required observing for five variables. After observing the subject for approximately sixty seconds, entries were made on the SOF on the following variables:

SETTING: The general teaching strategy common to high school mathematics classrooms.

L:Lecture/Discussion

S:Small Group

D:Directed Study (Self-Paced)

OBJECTIVE: Student behaviors generally related to the daily learning objectives.

Y:On the objective

N:Not on the objective

LEARNER MOVES: Specific observed behaviors of the student during the instructional sequence.

E:Engaged, written response

S:Engaged, spoken response

C:Engaged, covert activity (listening, thinking)

D:Engaged, receiving directions

I:Not engaged, interim activity (sharpening pencils, turning in and passing out papers, getting books, etc., that are a part of math activity.

W:Not engaged, waiting for help

O:Not engaged, off-task (periods where the student is inappropriately disengaged from a math task. Socializing, daydreaming, misbehaving, etc.).

GENERAL:

W:Waiting for lesson to start (or waiting after work is finished and no other activity is initiated).

T:Transition (periods of change from one activity to another).

M:Management (conduct of class business unrelated to instructional activity, e.g., roll-taking, bookkeeping, etc.)

B:Break (recreational or free time).

N:Non-academic Instruction (flag pledges, etc.).

O:Other academic Instruction

A:Absent

INTERRUPTIONS: Observable breaks in the instructional sequence.

I:Interruptions from outside the classroom (Public address announcements, people at the door, students leaving for trips, etc.).

At the conclusion of the ten weeks of observations, a total of 100 cycles of data with five recordings per cycle had been recorded for each subject. This provided a total of 30,000 classroom behavior observations for the sample total of 60 subjects.

Post-tests were administered during the third week in December of 1983 to every student in each of the ten classrooms. Even though analysis was done on only the six subjects per classroom, the tests were administered to all students to insure anonymity of subjects.

The data were analyzed using the Statistical Package for the Social Sciences (SPSS). The subprograms Frequencies and Scattergrams were run to determine trends: Pearson product-moment correlations were run to determine relationships; and, 2-tailed t-tests were computed as measures of significance of relationships.

Results of Data Analysis

Achievement gain, as measured by the difference between post-test scores and pre-test scores on the Assessment of Algebraic Competencies test, was treated as the independent variable. The dependent varibables selected for comparative analyses were those observed in the classroom. Scattergrams, Pearson R's, and 2-tailed t-tests of significance were computed for the various relationships. For the purposes of this research, a probability of 0.05 was chosen as the level of significance.

When achievement gain was compared to the classroom strategy, the results indicated a significant positive relationship between gain and the lecture/discussion method and a significant negative relationship between gain and the directed study strategy.

PLACE CHART I ABOUT HERE

As might appear intuitively obvious, achievement gain yielded a significant positive relationship with the amount of time students spent on tasks related to the learning objective and a significant negative relationship with amount of time students spent on tasks not related to the learning objective.

PLACE CHART II ABOUT HERE

When achievement gain was compared to engaged time and unengaged time, significant positive relationships were found with total engaged time and the subset of the total time called engaged covert behavior. Significant negative relationships were found between achievement gain and total unengaged time, between gain and the subset of total unengaged time called "waiting for help," and between gain the subset of total unengaged time called "off-task."

PLACE CHART III AND IV ABOUT HERE

The remainder of the subsets of total engaged time and total unengaged time failed to yield significant results. As indicated on Charts III and IV, these were achievement gain with "receiving directions, "engaged written," "engaged spoken," and "unengaged, interim activity."

Even though a comparison of achievement gain and attitude change yielded a positive correlation, the strength of the relationship did not meet the desired level of significance.

PLACE CHART V ABOUT HERE

Because it was of special interest to the researchers, further investigations were made of the relationships between the selected instructional strategy and on/off task behaviors.

PLACE CHARTS VI AND VII ABOUT HERE

Note that when the percentage of time spent on-task was compared to the percentage of time spent in a particular instructional strategy, a significant positive relationship was found between time spent on-task and the lecture/discussion strategy. While the other two observed strategies revealed a negative correlation, the strength of the relationship did not meet the set standard of 0.05.

Classroom Analyses

In order to have a baseline reference for practitioner implication, the data were analyzed from the point of view of a typical classroom, that is , one of 55-minutes length. Achievement gain data and time-on-task data were then normalized to the 55-minute class length.

PLACE CHART VIII ABOUT HERE

The average number of minutes on task for the total sample was 28, which represented 54.2 per cent of the total class time. Individual classrooms reflected a range from seventeen minutes of on-task time at the low end to 34 minutes at the high end.

When achievement gains for individual classrooms were compared to minutes of on-task time per classroom, a strong relationship was found to exist. ($P > 0.95$) In general, then, a significant positive relationship was found to exist between minutes of time spent on task during a class period and achievement gain.

The rotating time sequence method of data collection provided the means for a detailed analysis of the use of time during a typical 55-minute class period. Summary data for the entire sample as well as summary data for each classroom were analyzed.

PLACE CHART IX ABOUT HERE

Notice that the mean data for the total sample reflected a relatively low on-task rate at the beginning of the period, a maximum rate during the third cycle (18-24 minutes after the class period began), and a second relatively low on-task rate at the end of the typical period.

Subjective comparisons of the classrooms at the extremes of the achievement gain spectrum revealed that the low gain classroom followed a pattern similar to the overall mean but at a much lower magnitude. The high gain classroom, while beginning the period with a pattern virtually the same as the overall mean, began to differ after the fourth cycle. While other classrooms showed a continuing decline, or lack of incline in on-task rate, the high gain pattern reflected a continuing incline to the degree that on-task at the end of the period was higher at any other point in the period.

IMPLICATIONS

The value of this research lies in its implications for use by practicing administrators and teachers.

Implications for the teachers

A. Teachers should not allow students to begin the class with a period of off task time. The teacher should start the class on time using a format that will cause students to be actively involved in learning from class initialization. This means the teachers should plan activities for students while taking care of the class administrative duties (i.e. taking attendance, lunch counts, etc.).

B. Teachers need to plan their instructional strategies to fill the entire class period. Student engaged time fluctuates during any class period. The most significant downturn in student engaged time is during the first and last 10-15 minutes of the class period. In order to help diminish significant changes in student engaged time, teachers need to change their instructional activities. These activity changes cause students to be more interested, thus more real learning occurs.

C. Teachers must have control of the classroom for significant achievement to occur. Discipline problems in classrooms are interruptions that have a great affect on student achievement. Each time the teacher stops the engaged learning process to discipline a student the entire class is placed in an off task mode. Several minutes will be consumed from the time of discipline until engaged learning is once again at peak levels of efficiency. Each incident of discipline reduces the 28 minutes of engaged learning time from 2 to 4 minutes, this does not take into consideration serious confrontations.

Implications for the principals

A. Principals need to reduce classroom interruptions such as:
   1. Use of intercom systems for extraneous messages to teachers and students creates a loss of learning time to magnitude of 5. This means for each minute of interruption it takes 5 minutes for the students to return to on task activities.

   2. Limit the number of personal interruptions by office aides, secretaries, and students. This requires principals to make sure that unnecessary classroom contacts are not made.

B. A great deal of learning time is lost in assemblies of all types, including such activities as pep assemblies, various entertainment type programs, and programs promoting special interests. For example, a thirty-minute pep rally for each of ten football games results in the effective loss of five hours of instruction.

C. Encourage and vigorously pursue students with less than desirable attendance. The obvious: students can't learn if they are absent from class. If student learning time is reduced by classroom interruptions, assemblies, and absences it is little wonder that the results of basic skill testing and achievements scores have declined. The average student learning time is reduced from 175 days to approximately 135 days because of the aforementioned items. This amounts to a 33 per cent loss in allocated time.

Implications for supervision

A. Teachers who use a block of time for homework or seatwork assignments during a class period are, in most cases, adding to the learners off task time. Teachers who feel they need to give students the opportunity to complete homework assignments need techniques that will cause students to stay on task.

B. Teachers who planned several instructional strategies appeared to produce higher levels of engaged time among students than did those who limited strategies to lecture alone. One way to increase engaged time is to alternate lecture with appropriate practice, supported by the coaching technique. This methodology appears to yield the highest engaged learning time and greatest student achievement.

C. The teacher should establish academic achievement as an important goal in the classroom. Those that do this appear to have higher rates of engaged learning time. The no nonsense, down-to-business tone in the classroom indicates that academic achievement is expected by the teacher. In addition, these students understand that they are accountable for learning the material.

BIBLIOGRAPHY

Brandt, Ron, "On Improving Teacher Effextiveness: A Conversation with David Berliner," Educational Leadership, Vol. 40 (October, 1982), 12-15.

Clauset, Karl H., Jr. and Alan K. Gaynor, "A Systems Perspective on Effective Schools," Educational Leadership, Vol. 40, (December, 1982), 54-59.

Edmonds, Ronald R., "Programs of School Improvement: An Overview," Educational Leadership, Vol. 40 (December, 1982), 4-11.

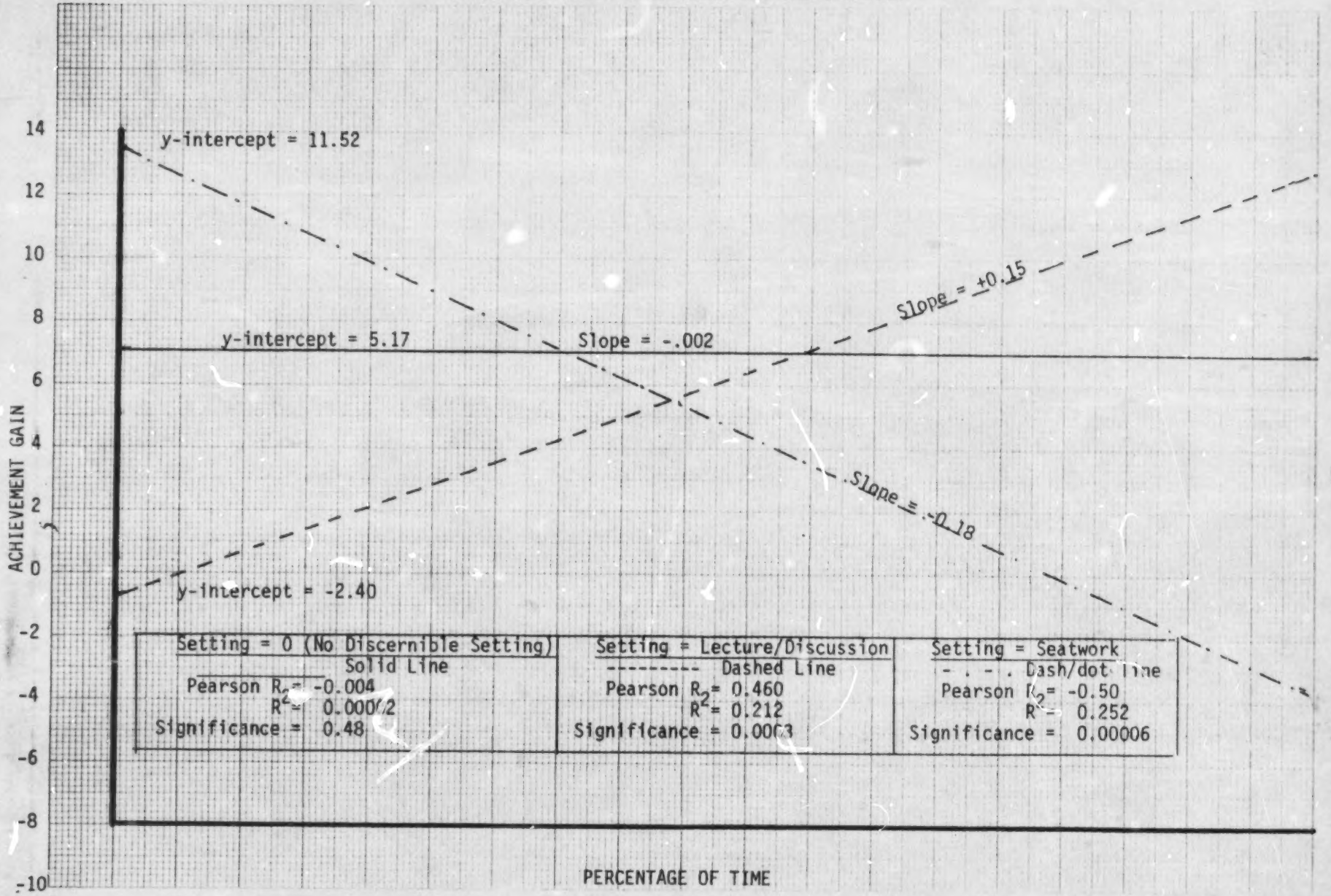
Fisher, Charles W., et al., "Teaching Behaviors, Academic Learning Time, and Student Achievement: An Overview," in Time to Learn. A Review of the Beginning Teacher Evaluation Study, Carolyn Denham and Ann Lieberman (eds.). Washington, D.C. (National Institute of Education, 1980).

Murphy, Joseph F., et al., "Academic Press: Translating High Expectations into School Policies and Classroom Practices," Educational Leadership, Vol. 40 (December, 1982), 22-26 .

_____, "Newsnotes," Phi Delta Kappan, Vol. 64 (February, 1983), 445.

Salmon, Paul B. (ed.). Time on Task: Using Instructional Time More Effectively. Arlington, Virginia (American Association of School Administrators, 1982).

CHART I
ACHIEVEMENT WITH CLASSROOM TEACHING STRATEGY



Setting = 0 (No Discernible Setting)	Setting = Lecture/Discussion	Setting = Seatwork
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R^2 = 0.00002	R^2 = 0.212	R^2 = 0.252
Significance = 0.48	Significance = 0.0003	Significance = 0.00006

CHART II

ACHIEVEMENT WITH TIME ON LEARNING OBJECTIVE

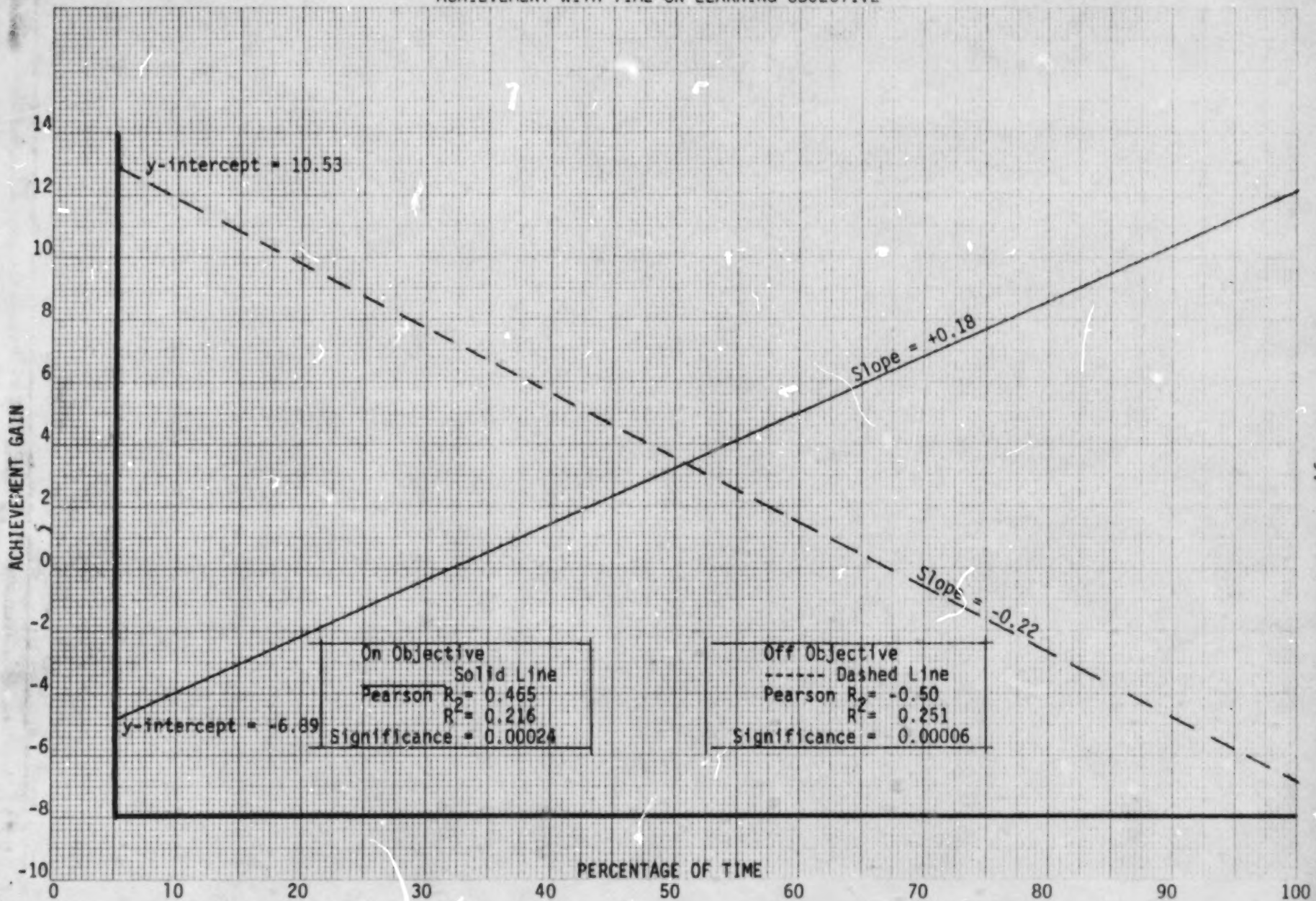


CHART III
ACHIEVEMENT WITH ENGAGED TIME

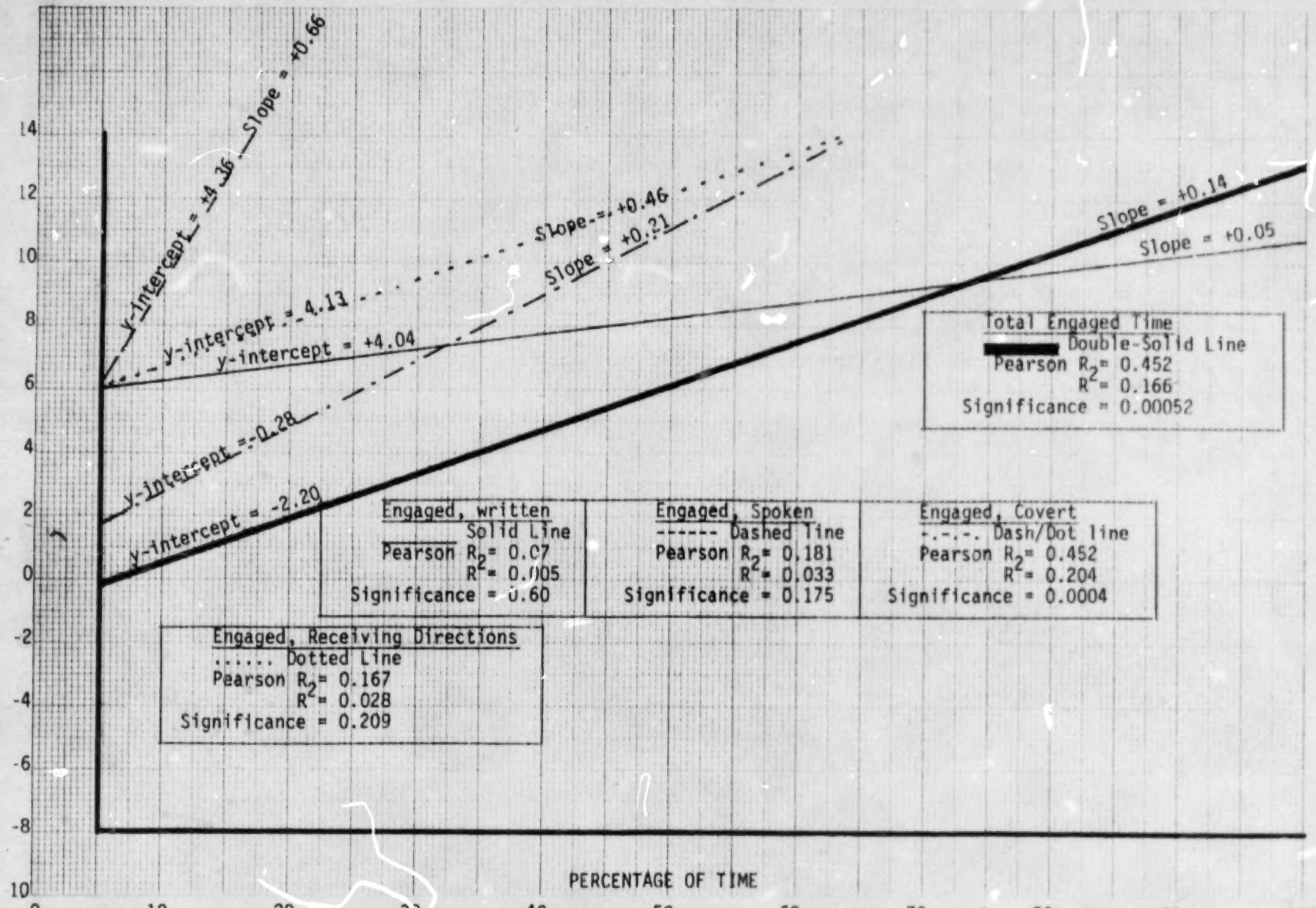


CHART IV
ACHIEVEMENT WITH UNENGAGED TIME

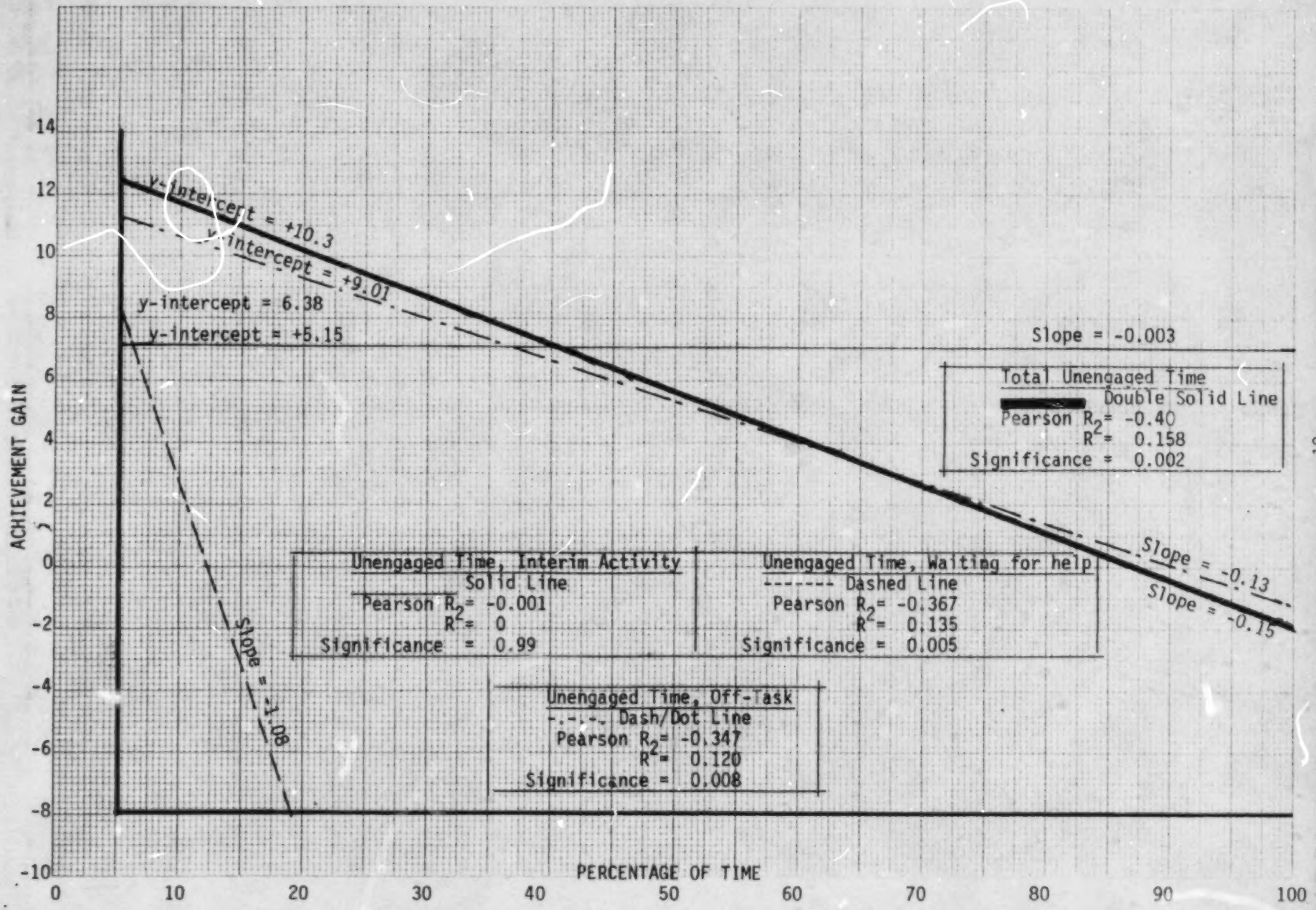


CHART V
ACHIEVEMENT VS. ATTITUDE

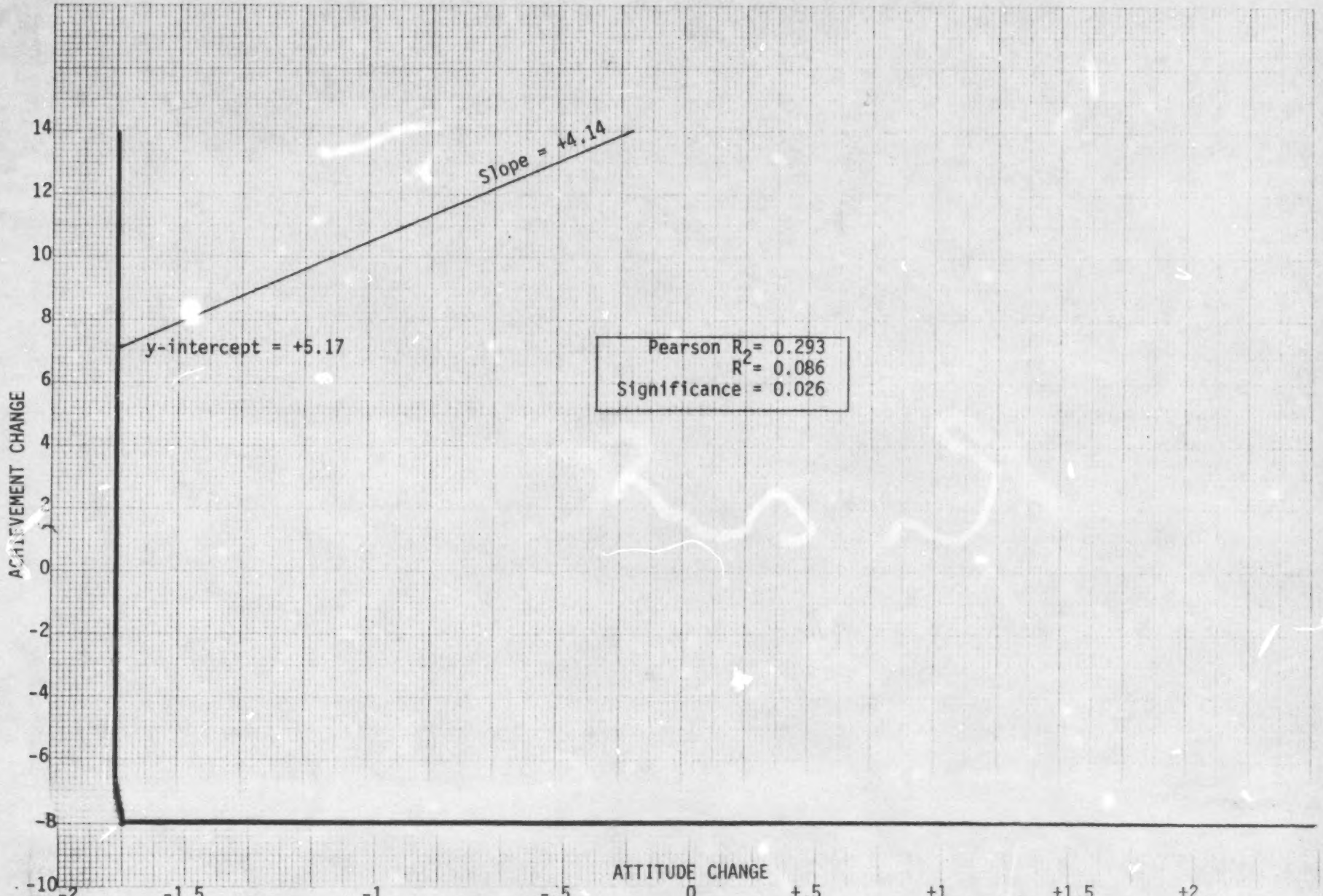
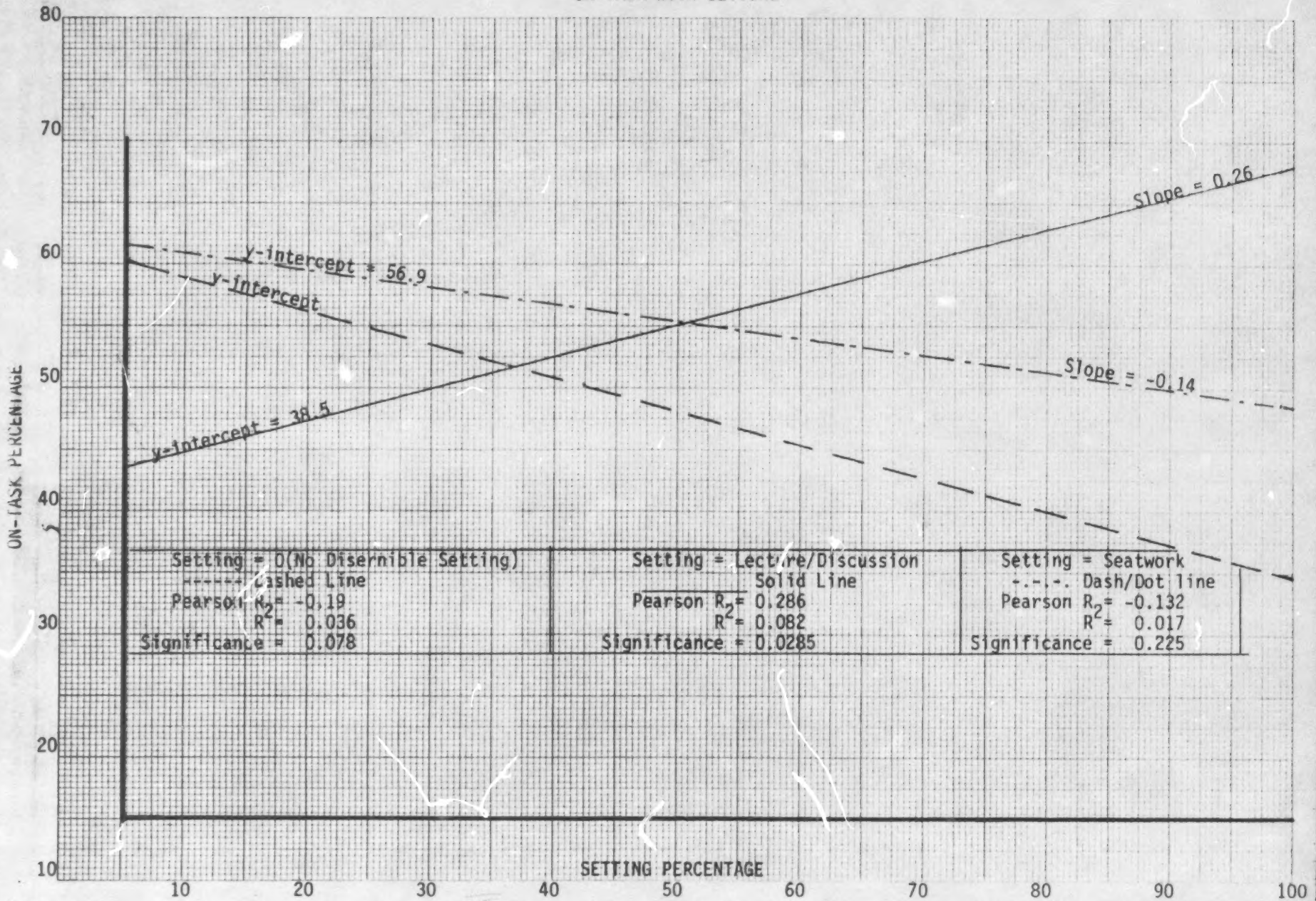


CHART VI
ON-TASK WITH SETTING



Setting = 0(No Disernible Setting)	Setting = Lecture/Discussion	Setting = Seatwork
------ Dashed Line	Solid Line	-.-.-. Dash/Dot line
Pearson R_2 = -0.19	Pearson R_2 = 0.286	Pearson R_2 = -0.132
R^2 = 0.036	R^2 = 0.082	R^2 = 0.017
Significance = 0.078	Significance = 0.0285	Significance = 0.225

CHART VII
OFF-TASK TIME WITH SETTING

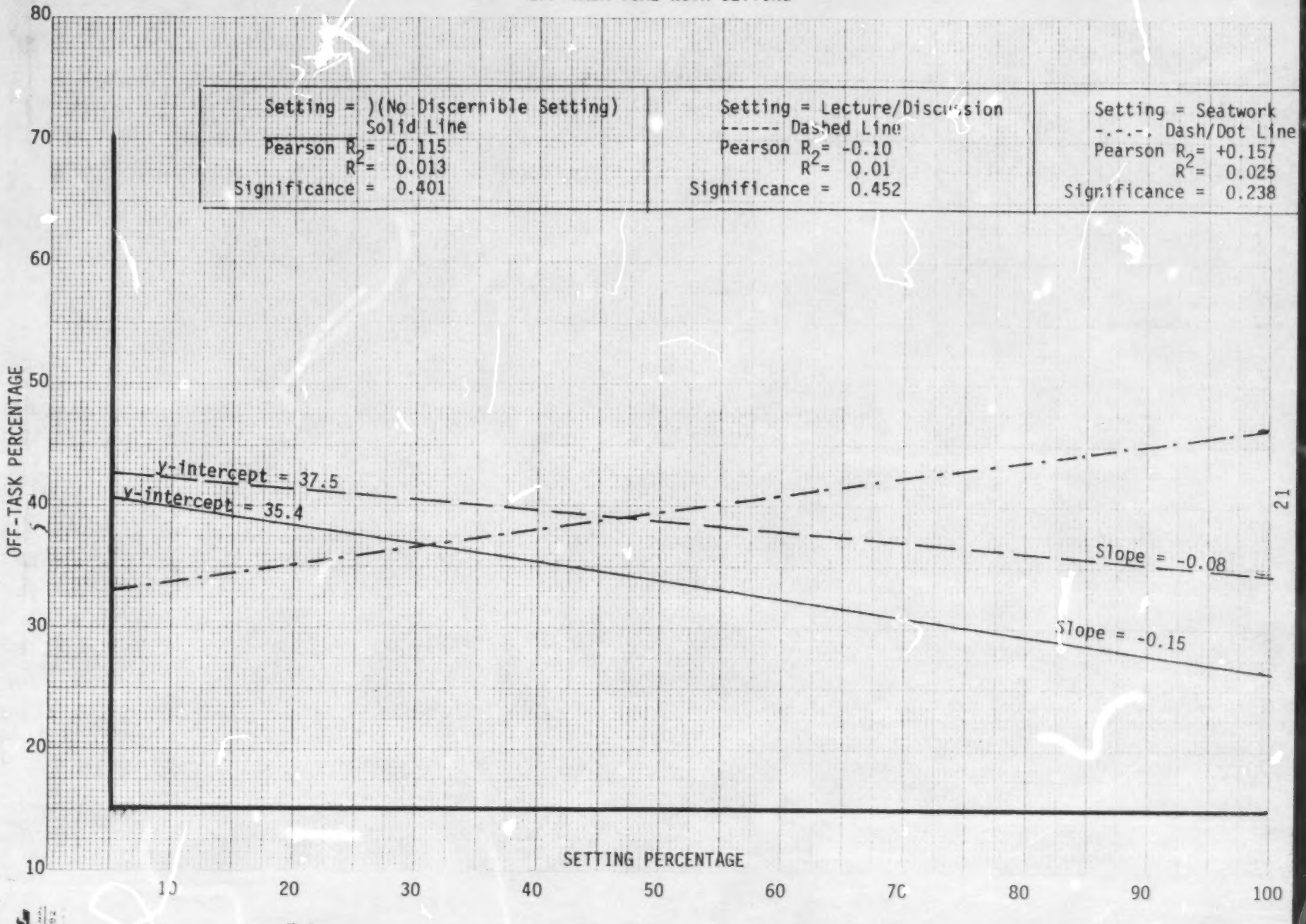


CHART VIII

ON-TASK TIME PER 35-MINUTE PERIOD (LEFT MARGIN)
and
ACHIEVEMENT GAIN (RIGHT MARGIN)

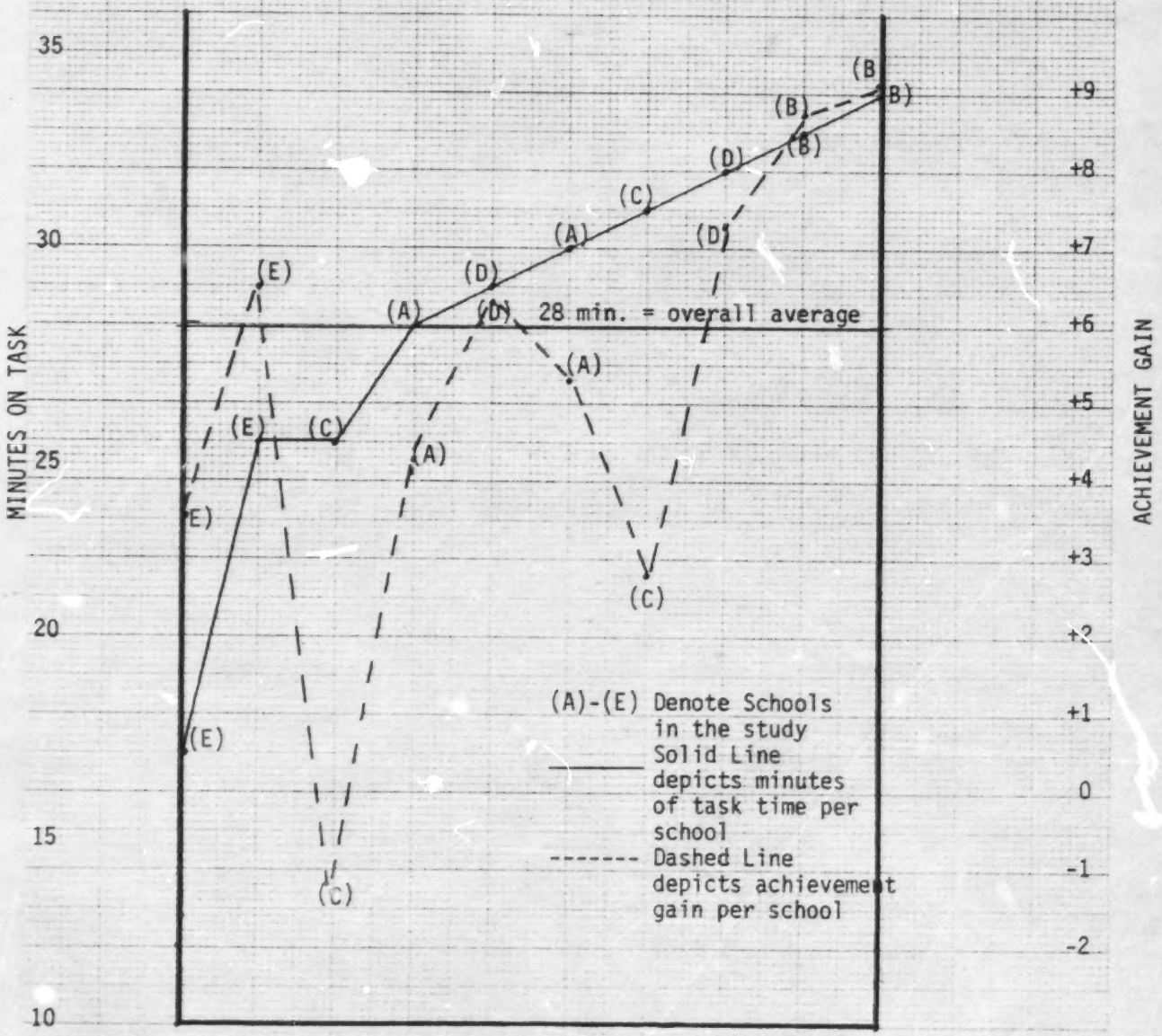
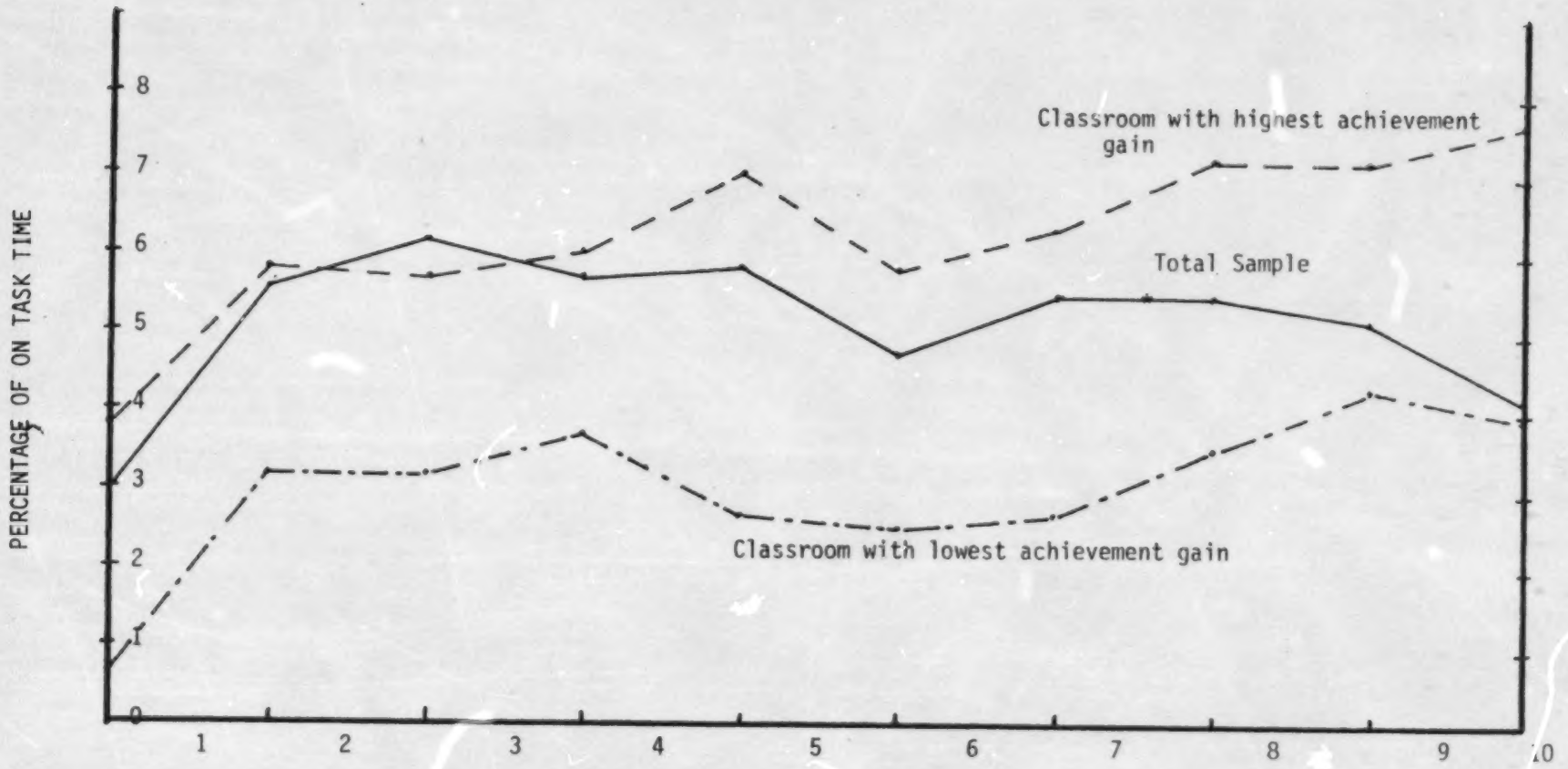


CHART IX
ON-TASK TIME (PERCENTAGE)
BY
RECORDING CYCLE (5-6 MIN.)



APPENDIX A

ASSESSMENT OF ALGEBRAIC COMPETENCIES

Directions:

Read each question carefully and decide which one of the answers is best. Notice the letter opposite your choice. Then, on a separate answer sheet, record the letter opposite the number of the problem.

Do not write in the test booklet!

For Example:

Test booklet

13. $4y + 9 = 1$

(A) $\frac{5}{2}$

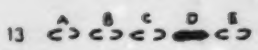
(B) 8

(C) - 7

(D) - 2

(E) 2

Answer sheet



Do not begin until you are told to do so.

You may use scratch paper if necessary.

FIRST YEAR ALGEBRA TEST

1. If $2x + 1 = 7$, then $x = (?)$

   A $\frac{1}{2}$

   B $\frac{1}{3}$

   C 3

   D 4

   E 11

2. The statement, "A certain number f increased by twice another number n is equal to 30," can be written

   A $f + 2n = 30$
   B $f + 2f = 30$
   C $2f + n = 30$
   D $2f + 2n = 30$
   E $2nf = 30$

3. $(-5) - (-9) = (?)$

   A -14
   B -4
   C 4
   D 14
   E 45

4. If $x = y = z = 1$, then $\frac{x - y}{x + z} = (?)$

   A -2

   B -1

   C 0

   D $\frac{1}{2}$

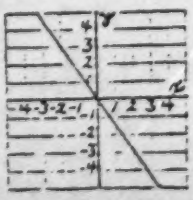
   E 1

5. $-2x + 5x - 9x = (?)$

   A $-16x$
   B $-14x$
   C $-11x$
   D $-6x$
   E $-2x$

6. The graph below shows that each change in x of 1 unit corresponds to a change in y of

   A 1 unit
   B 1½ units
   C 2 units
   D 3 units
   E 5 units



7. If n is an even number, what is the next larger even number?

   A $n - 2$
   B $n - 1$
   C $n + 1$
   D $n + 2$
   E $2n$

8. What is the coefficient of y in the expression $2y^5 + 6y^4 - 4y^2 - 5y + 1$?

   A -5
   B -1
   C 1
   D 2
   E 5

9. If $A = LW$ and if $A = 12$ and $L = 3$, then $W = (?)$

   A $\frac{3}{4}$

   B 3

   C 4

   D 12

   E 36

10. $\frac{x^7}{x^3} = (?)$

    A $x^{3.5}$

    B x^4

    C x^{10}

    D x^{21}

    E 3.5

11. Which of the following is equivalent to $x(+ a) - a(x - a)$?

    A $(x + a)(x - a)^2$
    B $(x + a)^2 (x - a)$
    C $(x + a)^3$
    D $(x + a)^2$
    E $x^2 + a^2$

12. Which of the following is an instance of the distributive principle?

    A $(x - y)(x + y) = (x - y)x + (x - y)y$
    B $7 + x + 5 = 12 + x$
    C $8 + x = x + 8$
    D $(x + y)(x-y) = (x - y)(x + y)$
    E $x + 0 = x$

13. Expand as indicated:
$(4b - 5k)^2$ =

A $4b^2 - 5k^2$

B $16b^2 - 40bk + 25k^2$

C $8b^2 - 10k^2$

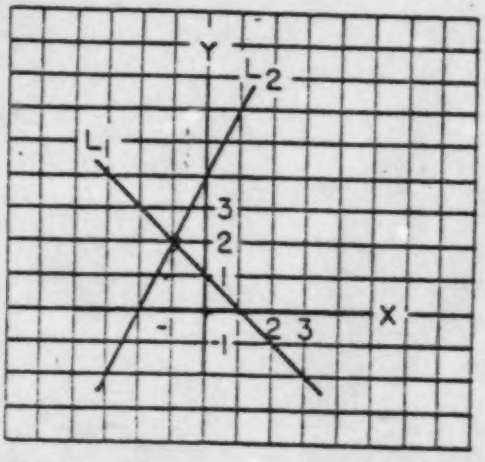
D $16b^2 - 20bk + 25k^2$

E $4b^2 + 5k^2$

14. If $\begin{matrix} x + y = 4 \\ x - y = 2, \end{matrix}$ then x = (?)

A 0
B 1
C 2
D 3
E 6

15.



The figure above shows the graphs of two linear equations. What is the solution of these equations?

A (-2,4)
B (-1,2)
C (-2,1)
D (1,4)
E (1,1)

16. If 9x - 63 = 18, x = (?)

A -9
B -5
C 0
D 5
E 9

17. What is the square root of $16b^8$?

A $2b^2$
B $4b^2$
C $4b^4$
D $8b^2$
E $8b^4$

18. $2x^2 (3x + 4xy)$ = (?)

A $6x^2 + 8x^2y$
B $3x^3 + 4x^3y$
C $6x^3 + 4x3y$
D $6x^3 + 8x^3y$
E $6x^3 + 6x^3y$

19. Solve $R = \frac{K}{\pi d}$ for d.

A $d = \frac{\pi R}{K}$

B $d = \frac{KR}{\pi}$

C $d = \frac{\pi K}{R}$

D $d = \frac{K}{\pi R}$

E $d = \pi KR$

20. Two of a student's test marks are 68 and 84. A third mark is at least 40. What is his lowest possible average for the three tests?

A 40
B 58
C 62
D 64
E 76

21. When factored, $4a^2 + 12ab^2$ = (?)

A $4a (a + 3b^2)$
B $4a (a + 12b^2)$
C $4ab((a + 3b)$
D $4ab (a + 12b)$
E $4a^2 (1 + 3b^2)$

22. A boy who has q quarters and d dimes buys p pencils at 5 cents each. How many cents does he have left?

A $q + d - p$
B $q + d - 5p$
C $25q + 2(d - p)$
D $25q + 10d - p$
E $25q + 10d - 5p$

23. The statement $x - 6 \leq 6$ is equivalent to

A $x \geq -36$

B $x \leq 0$

C $x \leq 12$

D $x \leq 36$

E $x \geq 12$

24. An automobile is moving at r miles per hour, and an airplane is moving three times as fast. How many hours will the plane require for a 500-mile flight?

A $\frac{1500}{r}$

B $\frac{500}{3r}$

C $\frac{3r}{500}$

D $500 - 3r$

E $1500r$

25. If $4x + 5y = 13$ and $2x + 3y = 7$, then $x = (?)$

A -2

B -1

C $\frac{1}{2}$

D 2

E 4

26. The expression $\sqrt{20a^3}$ equals

A $4a^2\sqrt{5a}$

B $2a\sqrt{10a}$

C $2a\sqrt{5a}$

D $10a^2\sqrt{2a}$

E $4a\sqrt{5a^2}$

27. Divide (Factor, etc.)

$$\frac{x^2 + 3x - 28}{x+5} \div \frac{5x - 20}{3x + 15} =$$

A $\frac{3x + 21}{15}$

B $\frac{5(x + 7)}{3}$

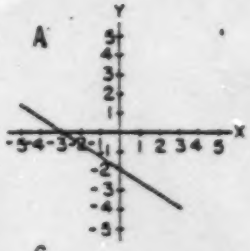
C $\frac{5x + 35}{15}$

D $\frac{x + 7}{5}$

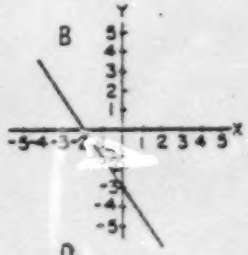
E $\frac{3(x + 7)}{5}$

28. Which of the following is the graph of $2x + 3y = 6$?

A



B



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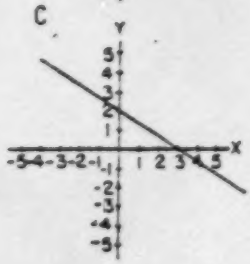

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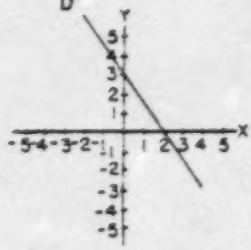
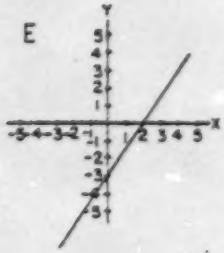


E



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29. If x is a real number, what are all the values of x for which $x^4 + 16$ is a positive number?

A All x greater than -2
B All x greater than zero
C All x greater than 2
D All x between -2 and 2
E All values of x

30. Solve for x: $2(x + 3) = 15$

A $\frac{9}{2}$

B 6

C 9

D $\frac{21}{2}$

E 10

31. Simplify radicals and combine:

$\frac{1}{2}\sqrt{72} + 2\sqrt{50} - \sqrt{98} =$

A $18\sqrt{2}$

B $7\sqrt{2}$

C $4\sqrt{2}$

D $6\sqrt{2}$

E $8\sqrt{2}$

32. Factor the following expression: $49a^2 - 9b^2$

A $(7a + 3b)(7a - 3b)$

B $(7a - 3b)^2$

C $9(7a^2 - b^2)$

D $40(a^2 - b^2)$

E cannot be factored

33. If $3x^2 + bx + 1 = 0$ when $x = 1$, what is b?

A -4

B -1

C 1

D 4

E It cannot be determined from the information given.

34. Which of the following expressions is equal to $(1 + x)(1 + y)$?

A $x + y$

B $1 + x + y$

C $1 + xy$

D $x + y + xy$

E $1 + x + y + xy$

35. $(-2)^3 (-3)^2 = (?)$

A -72

B -54

C 36

D 54

E 72

36. If $\frac{x}{3} - 1 = \frac{x}{5} + 2$, then $x = (?)$

A -15

B $-\frac{2}{3}$

C $\frac{3}{2}$

D 15

E $\frac{45}{2}$

37. Factor $3x^2 - 4x - 4$

A $(3x - 2)(x + 2)$

B $(3x + 2)(x - 2)$

C $(3x + 1)(x - 4)$

D $(3x - 4)(x + 1)$

E $(3x - 4)(x - 1)$

38. What is the result when $x^3 - x^2 - 17x + 20$ is divided by $x^2 + 3x - 5$?

A $x - 4$

B $x - 2$

C $x - 1$

D $x + 1$

E $x + 4$

39. If $a = 3$ and $b = 2$, then $\frac{ab^3}{(a - b)^2} = (?)$

A $\frac{18}{5}$

B $\frac{24}{5}$

C 18

D 24

E 216

40. What value of x, when substituted in $\frac{1}{x - 2}$, will make this fraction meaningless?

A -2

B 0

C 2

D Any number between -2 and 0

E Any number between 0 and 2

41. $\frac{5a^2b^2}{4} \div \frac{10b^2}{3a^2} = (?)$

A $\frac{3b^4}{8}$

B $\frac{3a^4}{8}$

C $\frac{25b^4}{6}$

D $\frac{25a^4}{6}$

E $\frac{3}{8a^2b^2}$

42. By factoring, find the roots of the equation:

$2x^2 - 9x + 4 = 0$

A Solution set is $\{1,2\}$

B Solution set is $\{\frac{1}{2},4\}$

C Solution set is $\{1,4\}$

D Solution set is $\{\frac{1}{2},2\}$

E Solution set is $\{2,4\}$

43. Solve the equation

$x^2 + 10x - 24 = 0$ for x.

A $x = 12$ or $x = -2$

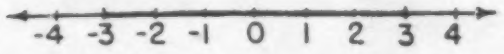
B $x = 12$ or $x = 2$

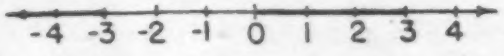
C $x = 6$ or $x = -4$

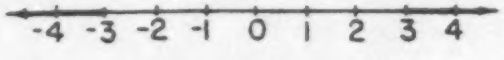
D $x = 6$ or $x = 4$

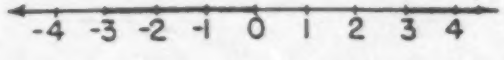
E $x = -12$ or $x = 2$

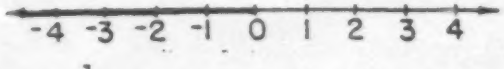
44. On which of the following number lines does the heavy line represent all numbers x such that $-3 \leq x \leq 3$?

A 

B 

C 

D 

E 

45. If $y = \frac{1}{x}$ and x is greater than 0, which of the following statements is true?

A As x increases, y increases

B As x increases, y decreases

C As x decreases, y decreases

D When x is greater than 1, y is greater than 1.

E When x is less than 1, y is less than 1

46. What number must be added to $x^2 - 6x + 4$ in order to make it a perfect square?

A -4

B 0

C 2

D 5

E 32

47. For what values of x is $\frac{x}{6} = \frac{1}{2}(x - 3) - \frac{x}{3}$ a true statement?

A 0 only
B 3 only
C 0 and 3 only
D All values
E No value

48. Solve the formula $E = \frac{ar}{a + r}$ for r.

A $r = \frac{aE}{a - E}$

B $r = \frac{aE}{a + E}$

C $r = aE - a + E$

D $r = aE - a - E$

E $r = a - \frac{E}{a - E}$

49. If x is greater than 3, which of the following is the smallest?

A $\frac{3}{x}$

B $\frac{3}{x + 1}$

C $\frac{3}{x - 1}$

D $\frac{x}{3}$

E $\frac{x + 1}{3}$

50. Add as indicated. Simplify answers:

$\frac{9(x-7)}{4} + \frac{5(x+2)}{3} =$

A $14x - 53$

B $\frac{14x - 53}{12}$

C $47x - 149$

D $\frac{47x - 149}{12}$

E $49x - 53$

NAME: _____

TEACHER: _____

APPENDIX B

MATH ATTITUDE SCALE

Directions: Please write your name in the upper right hand corner. Each of the statements on this opinionnaire expresses a feeling which a particular person has toward mathematics. You are to express, on a five-point scale, the extent of agreement between the feeling expressed in each statement and your own personal feeling. The five points are: Strongly Disagree(A), Disagree(B), Undecided(C), Agree(D), Strongly Agree(E). You are to darken the bubble on the answer sheet which best indicates how closely you agree or disagree with the feeling expressed in each statement AS IT CONCERNS YOU.

1.	I am always under a terrible strain in a math class.	A B C D E
2.	I do not like mathematics, and it scares me to have to take it.	A B C D E
3.	Mathematics is very interesting to me, and I enjoy math courses.	A B C D E
4.	Mathematics is fascinating and fun.	A B C D E
5.	Mathematics makes me feel secure, and at the same time it is stimulating.	A B C D E
6.	My mind goes blank, and I am unable to think clearly when working math.	A B C D E
7.	I feel a sense of insecurity when attempting mathematics.	A B C D E
8.	Mathematics makes me feel uncomfortable, restless, irritable, and impatient.	A B C D E
9.	The feeling that I have toward mathematics is a good feeling.	A B C D E
10.	Mathematics makes me feel as though I'm lost in a jungle of numbers and can't find my way out.	A B C D E
11.	Mathematics is something which I enjoy a great deal.	A B C D E
12.	When I hear the word math, I have a feeling of dislike.	A B C D E
13.	I approach math with a feeling of hesitation, resulting from a fear of not being able to do math.	A B C D E
14.	I really like mathematics.	A B C D E
15.	Mathematics is a course in school which I have always enjoyed studying.	A B C D E
16.	It makes me nervous to even think about having to do a math problem.	A B C D E
17.	I have never like math, and it is my most dreaded subject.	A B C D E
18.	I am happier in a math class than in any other class.	A B C D E
19.	I feel at ease in mathematics, and I like it very much.	A B C D E
20.	I feel a definite positive reaction to mathematics: it's enjoyable.	A B C D E

APPENDIX C

STUDENT OBSERVATION FORM

School:_____ Teacher:_____ Date:_____ Time:_____

	Cycle 1	Cycle 2	Cycle 3	Cycle 4	Cycle 5	Cycle 6	Cycle 7	Cycle 8	Cycle 9	Cycle 10
STG	L S D	L S D	L S D	L S D	L S D	L S D	L S D	L S D	L S D	L S D
OBJ	Y N Y N Y N	Y N Y N Y N	Y N Y N Y N	Y N Y N Y N	Y N Y N Y N	Y N Y N Y N	Y N Y N Y N	Y N Y N Y N	Y N Y N Y N	Y N Y N Y N
LNR MVE	E: R S C D I N: W T M B N O A	E: R S C D I N: W T M B N O A	E: R S C D I N: W T M B N O A	E: R S C D I N: W T M B N O A	E: R S C D I N: W T M B N O A	E: W S C D I N: R T M B N O A	E: W S C D I N: R T M B N O A	E: W S C D I N: R T M B N O A	E: W S C D I N: R T M B N O A	E: W S C D I N: R T M B N O A
GENERAL	W T M B N O A	W T M B N O A	W T M B N O A	W T M B N O A	W T M B N O A	R T M B N O A	R T M B N O A	R T M B N O A	R T M B N O A	R T M B N O A
OUT	I	I	I	I	I	I	I	I	I	I

Codes: Setting (STG)
- L: Lecture/Discussion
- S: Small Group
- D: Directed Study (Self-Paced)

Objectives (OBJ)
- Y: On the objective
- N: Not on the objective

Learner Moves (LNR MVE)
- R: Engaged, Written
- S: Engaged Oral (Spoken)
- C: Engaged Covert (Listening, Thinking)
- D: Engaged receiving directions
- I: Not engaged, interim activity
- W: Not engaged, waiting for help
- O: Not engaged, off-task

General (GENERAL)
- W: Waiting for lesson to start
- T: Transition
- M: Management
- B: Break
- N: Non-academic instruction
- O: Other academic instruction
- A: Absent

Outside Interruptions (OUT)
- I: Interruptions from outside classroom

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